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January 29, 2008

Brandon Perkins, Task Monitor
United States Environmental Protection Agency
1200 Sixth Avenue, Mail Stop ECL-112
Seattle, Washington 98121

Re: Contract Number: EP-S7-06-02
Technical Direction Document Number: 07-10-0005
Final Tuluksak River Preliminary Assessment Report

Dear Mr. Perkins:

Enclosed please find the final preliminary assessment report for the Tuluksak River site, which is located near Tuluksak, Alaska. If you have any question regarding this submittal, please call me at (206) 624-9537.

Sincerely,
ECOLOGY AND ENVIRONMENT, INC.

Renee L Nordeen

Renee Nordeen
START-3 Project Leader

cc: Kerrie M. Stewart, START-3 Project Manager, E & E, Seattle, Washington

PRELIMINARY ASSESSMENT REPORT

Site Name: Tuluksak River
EPA ID Number: AKN 001002722
Location: Tuluksak River; River Mile 78 to River Mile 15
City: Near Tuluksak, Alaska
County: Unorganized
State: Alaska

Prepared by: Kerrie Stewart, Project Manager, E & E, Seattle, Washington
Prepared for: Brandon Perkins, Task Monitor, EPA, Seattle, Washington
Date: January 2008

Site Description:

The site consists of the 40.49 mile stretch of the Tuluksak River from near the headwater to the confluence of the Tuluksak River with the Kuskowkim River and Bear Creek from its headwaters to the confluence with the Tuluksak River. (Figure 1). Placer mining has been conducted at a number of mines in the upper reaches of the Tuluksak River for over 100 years. Additionally, dredging of the Tuluksak River has been conducted. The Tuluksak River is a slow moving, meandering stream over most of its length, cutting through several tundra areas in its lower section (Collazzi and Maurer 1985). The Fog River, a major tributary, drains a large area of tundra and contributes significantly to the brown color of the water in the river's lower section (Alt 1977). The Tuluksak River lies within the Yukon Delta National Wildlife Refuge.

The upper Tuluksak basin is comprised of tightly folded Cretaceous rocks with interbedded layers of greywacke and shale, intruded by Cretaceous granitic rocks. Jurassic volcanic and sedimentary rocks in the foothills give to Quaternary silt and sand deposits on the extensive lowlands (Beikman 1974). The basin is generally underlain by moderately thick to thin permafrost, with isolated masses of permafrost in the mountains. Bedrock is exposed in parts of the upper basin, with alpine tundra, sedges, mosses, .low shrubs and scattered strands of black spruce (Collazzi and Maurer 1985).

The Tuluksak River basin lies within the transitional climatic zone of Alaska and serves as a primary route for gaining access to most wildlife resources that are utilized by the village of Tuluksak. Most resources are harvested along the Tuluksak River and adjacent areas. These wild resources are all harvested within 60 miles of the community, although fishing activities occurred within 12 miles of the settlement (Andrews and Peterson 1987).

Operations Waste Characteristics:
Thirteen mines have been identified as potential contributors to contamination known to occur in the Tuluksak River. The mine locations are presented in Figure 1. Due to the mining practices in the area, it is possible that contamination has migrated from the mines along Bear Creek and the Tuluksak River to the town of Tuluksak. The 13 mines that may be contributing to sediment contamination in the Tuluksak River include: the Bonanza Creek Mine, the Rock Creek Mine, the California Creek Mine, the Bear Creek Mine, the Upper Tuluksak River Mine, the Tiny Gulch Mine, The Tuluksak River Mine, the Granite Creek, Mine, the Tuluksak River prospect, and three unnamed mines. Gold is the primary mineral that is being mined; however, silver, platinum, and mercury has historically been mined at some of the mines.

Placer deposits are mineral bearing deposits found in weathered residuum and alluvium. Placers are unconsolidated sedimentary deposits, although, depending on the nature of the associated materials, placers may be cemented to varying degrees. Placers occurring within the permafrost are usually frozen solid (EPA 1994).

Actual processes used at these mines are not available; therefore, general placer mining processes are described below. Gold placer mining consists of three major operational steps: extraction, beneficiation and processing.

Extraction is defined as removing ore material from a deposit and encompasses all activities prior to beneficiation. Historically, large-scale placer mining operations used hydraulic methods to excavate pay dirt whereas small scale methods for extraction of ore material included panning and suction dredging. In hydraulic mining, water under pressure is forced through an adjustable nozzle called a monitor or giant and directed at a bank to excavate gold placer pay streak and to transport it to a recovery unit, which is generally a sluice box. The pressurized water jet can also be used to thaw frozen muck and to break up and wash away overburden. Small-scale methods combine extraction and beneficiation steps because the extraction phase of the placer operation is integrated with beneficiation. Panning is a fairly rudimentary gravity separation technique that recovers gold concentrate. It is also a method used by prospectors to evaluate a placer gold deposit to determine whether it can be mined profitably. (EPA 1994)

Beneficiation is the operation by which gold particles are separated from the large quantities of alluvial sediments. Beneficiation typically involves three general steps: the first is to remove grossly oversized material from the smaller fraction that contains the gold, the second to concentrate the gold, and the third to separate the fine gold from other fine, heavy metals (EPA 1994). Equipment utilized during this operation include: bulldozers, front-end loader, backhoe, dragline or conveyor belt, sluices, jigs, shaking tables, spiral concentrators or pinched sluices. (EPA 1994)

Extraction and beneficiation operations generate waste rock and tailings. Waste rock consists of material that contains no gold and must be removed to access the pay zone. It is generally disposed of in waste rock dumps (or piles) near the point of excavation; however; in some cases waste rock is stored and later returned to the cut or backfilled. Tailings are generated from gravity concentration operations and consist of slurry of gangue a non-gold material. At early placer mines, mercury was frequently added to sluice boxes to augment the recovery of fine gold. Mercury amalgamation produced a slurry waste composed of a mercury-tainted solution and gangue. At most gold placer operations, the disposal of tailings requires a permanent site with adequate capacity for the life of the mine. Tailings are typically managed in tailings impoundments or used for construction. Tailings impoundments associated with gold placer mines are generally unlined containment areas for wet tailings in the form of slurries. (EPA 1994)

Processing operations, which include smelting, generated final, marketable product bullion from the gold concentrate produced in beneficiation.

Historically, the most severe impacts associated with placer mining activities have been physical disturbances to stream channels and the addition of large quantities of sediment downstream. This sediment may have contained increasing concentrations of heavy metals such as arsenic copper lead, and mercury generated as a result of mining activities.

Waste rock and tailings generated during placer mining operations are a potential source of contamination.

Pathways:
The ground water migration pathway, the soil exposure pathway, and the air migration pathways have not been included as this PA was designed to focus solely on the surface water migration pathway.

Surface Water Migration Pathway:
The surface water migration pathway target distance limit (TDL) begins at the probable points of entry (PPEs) of surface water runoff from sources to a surface water body and continues downstream either 15 miles or to the most downstream point of known contamination. Figure 2 depicts the surface migration TDL.

There are thirteen probable points of entry (PPE) that exist for the site and are associated with each mine where contamination runoff will enter the Tuluksak River. PPE1 is associated with sources at the unnamed mine at Bonanza Creek where runoff enters Bonanza Creek, PPE 2 is associated with sources at Rocky Creek Mine where runoff enters Rocky Creek, PPE 3 is associated with sources at California Creek Mine where runoff enters Tuluksak River, PPE 4 is associated with sources at an unnamed mine near the California Creek Mine where runoff enters California Creek, PPE 5 is associated with sources at the Bear Creek Mine where runoff enters Bear Creek, PPE 6 is associated with sources from the Upper Tuluksak River Mine where runoff enters the Tuluksak River, PPE 7 is associated with sources at an unnamed mine on the south side of the Tuluksak River where runoff enters the Tuluksak River, PPE 8 is associated with sources at the Tiny Gulch Mine where runoff enters the Tuluksak River, PPE 9 is associated with sources at the Tuluksak River Mine where runoff enters the Tuluksak River, PPE 10 is associated with sources at an unnamed mine on lower Slate Creek where runoff enters Slate Creek, PPE 11 is associated with sources at the NYAC Tuluksak River Mine where runoff enters the Tuluksak River, PPE 12 is associated with sources at the Granite Creek Mine where runoff enters Granite Creek, finally, PPE 13 is associated with sources at the Tuluksak River Prospect below the Granite Creek Mine where runoff enters the Tuluksak River. All of the PPEs either flow directly into the Tuluksak River or into water bodies that discharge into the Tuluksak River.

It is possible that contamination from previous mining practices has migrated downstream to the town of Tuluksak. It is assumed that a zone of actual contamination is present from PPE 1 to the Town of Tuluksak.

The flow rates of Bear Creek, the unnamed tributaries, and the Tuluksak River are not recorded. It is estimated the flow rates of the unnamed tributaries and Bear Creek is between 10 to 100 cubic feet per second (cfs). The flow rate is estimated to be greater than 100 to 1,000 cfs.

The 2-year 24-hour rainfall event for the area is 1.5 inches (ENRI UAA 1992). The average annual precipitation for Tuluksak, Alaska is 66 inches (ADCED 2007). The drainage area for all sources at the site is greater than 100 and less than 1,000 acres (Hanson 2007).

Soils at the site are classified into three different principal components: Histic Pergelic Cryaquepts, Pergelic Cryofibrists, and Typic Cryofluvents (USDA 1979).

The Histic Pergelic Cryaquepts comprises approximately 55% of the soils and are poorly drained on nearly level to moderate slopes in broad valleys and large basins. The soils developed in nonacid alluvium. Below a thick mat of partly decomposed organic matter, the soils have a mottled gray silt loam horizon that is shallow over permafrost. In a few places on the terranes and ground moraines they have a gravely substratum. (USDA 1979)

The Pergelic Cryofibrists comprises approximately 40% of the soils and are poorly drained organic soils that lie in broad depressions, meander scars, and on the borders of shallow lakes. These soils consist of stratified layers of fibrous moss and sedge peat that is usually very strongly acid. The permafrost table is shallow. (USDA 1979)

The Typic Cryfluvents comprises approximately 5% of the soils and are deep, well drained silty soils on nearly level natural levee bordering rivers. The soils consist of nonacid to calcareous stratified silty and fine sandy alluvium. In most places they are underlain by very gravelly sand. Permafrost is either deep or absent. (USDA 1979)

The Alaskan Communities Flood Hazard Data indicates that flooding has occurred in the Tuluksak Village in the 1970s. Based on this information, the START assumes the site area is within a 100-year flood plain (USACE 2007)

<u>Targets:</u>

There are no drinking water intakes located within the TDL.

Surface water within the TDL is not used for the irrigation of greater than 5 acres of commercial food or commercial forage crops, watering of commercial livestock, as an ingredient in commercial food preparation, or as a supply for a major or designated water recreation area.

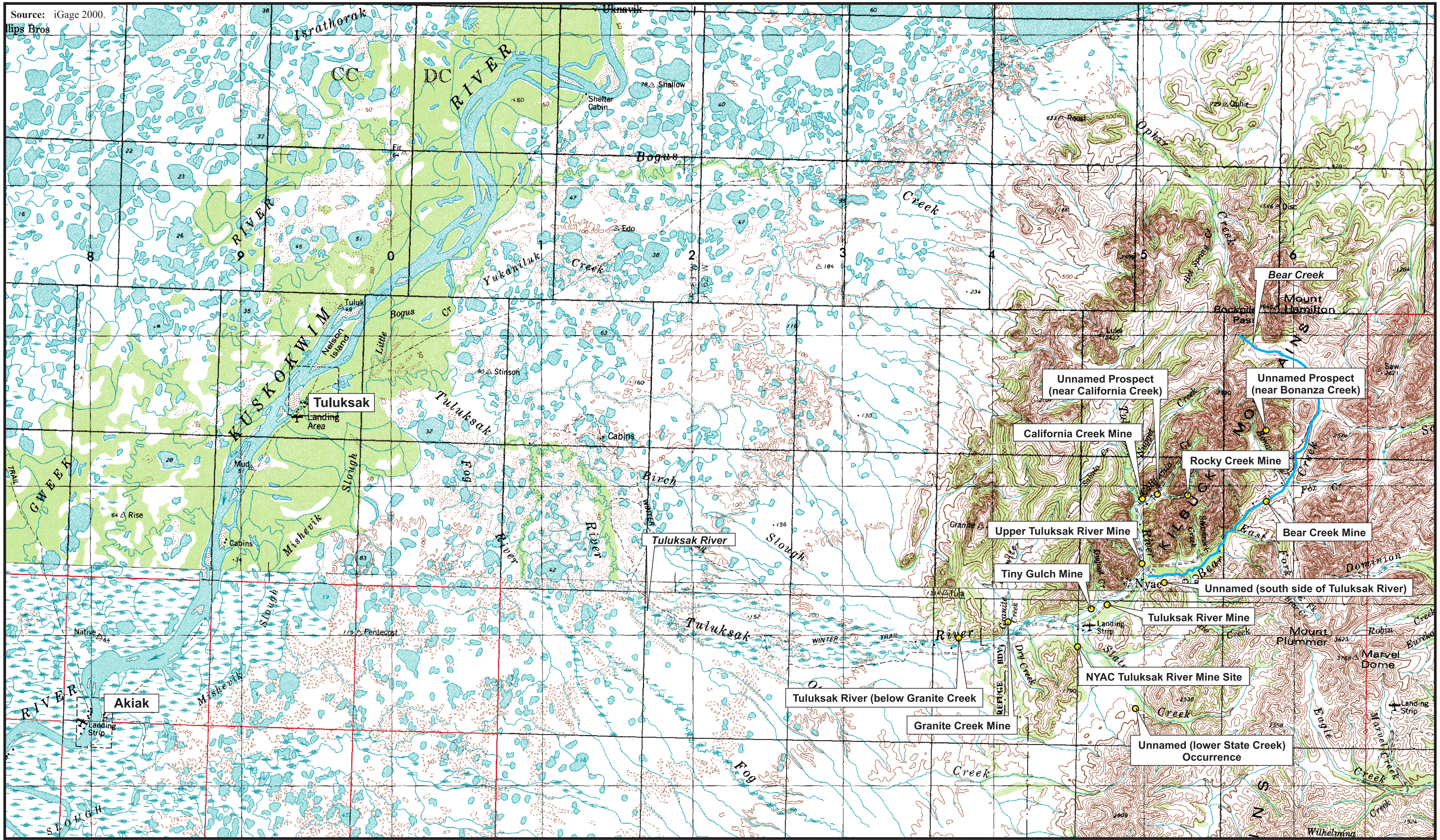
No commercial fishing is known to occur along the Tuluksak River (Bue 2007). Tribal members have reported eating fish caught from the Tuluksak River. The fish harvesting on the Tuluksak River is not recorded by ADFG or by the tribe. Limited sport fishing occurs on the Tuluksak River. (Chythlook 2008).

The United States Fish and Wildlife Service (USFWS) manage plant and animal species. There are no Federal- or State-listed threatened or endangered species within the TDL (Balough 2007)

Wetland information is not available for the area. Based on aerial photograph it appears that wetlands may be present along the TDL.

<u>Recommendation</u>

Extensive placer mining for gold has drastically and adversely impacted much of the riverine, riparian, and floodplain habitat of the upper Tuluksak River (Crayton 1990). Tailings and other mining waste may be migrating from the sources and impacting downstream targets such as wetlands, and a fishery. Further investigation of the site under the Comprehensive Environmental Response, Compensation, and Liability Act is recommended.



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0 2.5 5
Approximate Scale in Miles

TULUKSAK RIVER
PRELIMINARY ASSESSMENT
Tuluksak, Alaska

Figure 1
SITE MAP

Date:	Drawn by:	
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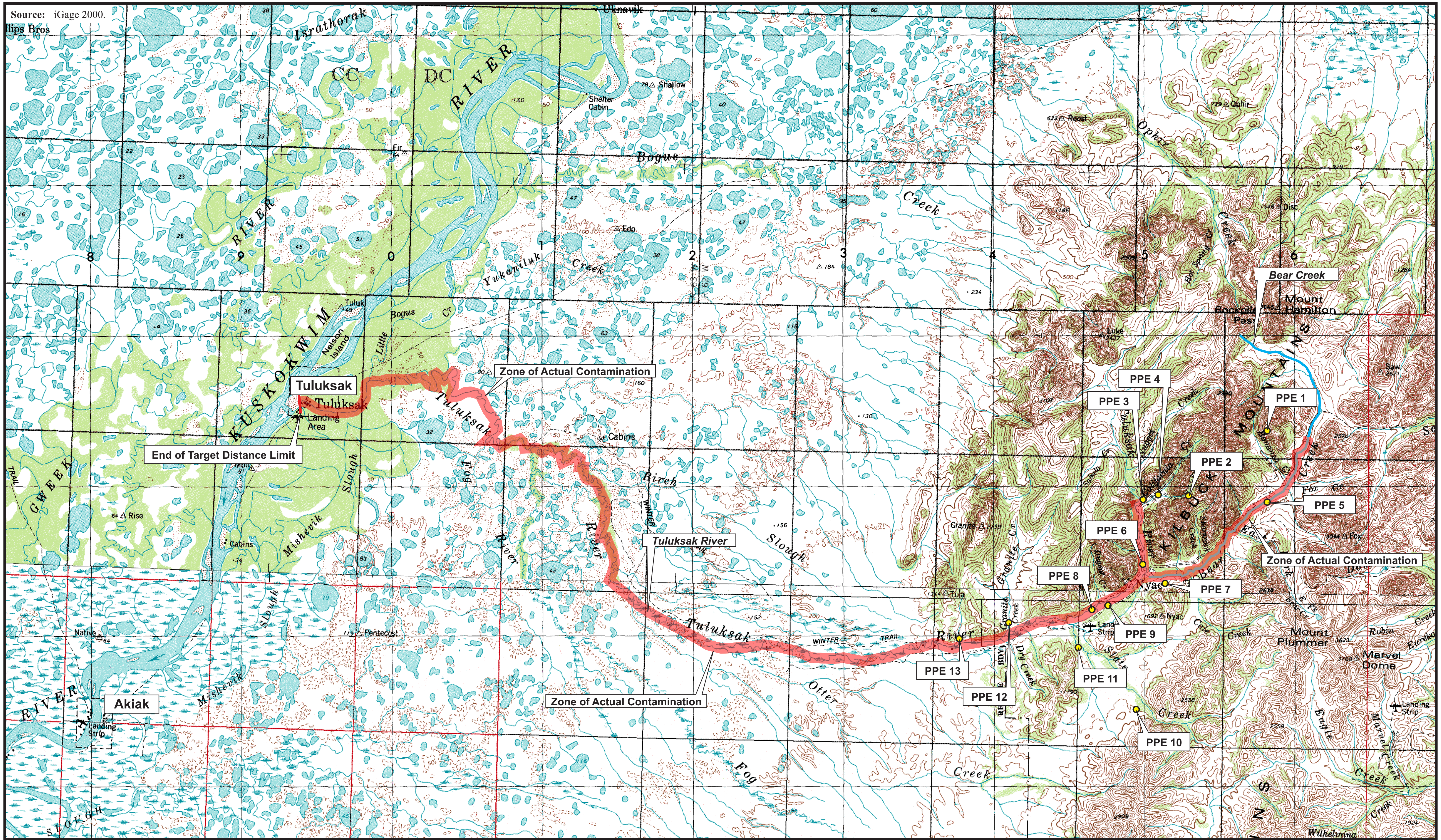

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0 2.5 5
Approximate Scale in Miles

TULUKSAK RIVER
PRELIMINARY ASSESSMENT
Tuluksak, Alaska

Figure 2
TARGET DISTANCE LIMIT MAP

Date:	Drawn by:	
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References

Alaska Department of Community and Economic Development (ADCED) May 7, 2007, Alaska *Community Database, Tuluksak, Community Overview*, accessed at http://www.dced.state.ak.us/dca/commdb/CF_BLOCK.cfm.

Andrews Elizabeth, and Peterson, Raymond, Alaska Department of Fish and Game Division of Subsistence *Technical Paper No. 87 Wild Resource Use of the Tuluksak River Drainage by Residents of Tuluksak 1980-1983.*

Balough, Greg, May 16, 2007, United States Fish and Wildlife Service, Wildlife Biologist, personal communication regarding threatened and endangered species within the Tuluksak River, with Dan Frank, Ecology and Environment, Inc., Seattle, Washington.

Bue, Douglas, May 23, 2007, Alaska Department of Fish and Game, telephone conversation regarding fishing on the Tuluksak River with Kerrie Stewart, Ecology & Environment Inc.

Bureau of Land Management (BLM), November 2005, Alaska Open File Report 103 *An Investigation of the Geology and Gold Mineralization in the Nyac District, Southwest Alaska* by Zachary Wenz, Anchorage, Alaska.

Chythlook, John, January 10, 2008, Kuskokwim Area Management Biologist, State of Alaska Fish and Game, personal communication regarding sport fishing on the Tuluksak River, with Kerrie Stewart, Ecology and Environment, Seattle, Washington.

Collazzi, E.J. and Maurer M.A., 1985, Hydrologic Reconnaissance of the Tuluksak River Basin, Alaska.

Crayton, Wayne, M. November 1990, Report of Findings Placer Mining Impacts-Tuluksak River for Fiscal Years 1987, 1988, and 1989 Prepared for the U.S. Fish and Wildlife Service Yukon Delta National Wildlife Refuge Bethel, Alaska.

Environment and Natural Resource Institute University of Alaska Anchorage (ENRI UAA) September 1992, *Technical Paper No. 47 Probable Maximum Precipitation and Rainfall-Frequency Data for Alaska*. Anchorage, Alaska.

Lamont, George, Sr., April 6, 2007, Tuluksak Native Community Indian General Assistance Program Coordinator, personal communication regarding the corroded drums and four landings on the Tuluksak River, with Kerrie Stewart, Ecology and Environment, Inc., Seattle, Washington.

Hanson, Al, May 24, 2007, GIS Analyst, Ecology and Environment, Inc. memorandum to Kerrie Stewart, Ecology and Environment, Inc., regarding population and wetland acreage for the Tuluksak Native Community site, Seattle, Washington.

iGage 2000 Mapping Corporation, AllTopo Maps: Alaska, Russian Mission Quadrangle and Bethel Quadrangle Topographic Maps.

Rieger, Samuel, Schoepthorster, D.B., and Furbagh, C.E., 1979 Exploratory Soil Survey of Alaska, United States Department of Agriculture (USDA) Soil Conservation Service Report, pages 100 and 101.

United States Army Corps of Engineers, Alaska District (USACE), June 1993, Alaskan Communities, Flood Hazard Data, Anchorage, Alaska

United States Environmental Protection Agency (EPA), October 1994, Extraction and Beneficiation of Ores and Minerals Gold Placers Technical Resource Document Volume 6.